REMARKS

The application has been reviewed in light of the Office Action dated November 4, 2006. Claims 1-23 were pending. By this Amendment, claims 1, 6 and 14-17 have been amended to clarify the claimed subject matter, without narrowing a scope of the claims, and new claims 24-29 have been added. Accordingly, claims 1-29 are now pending, with claims 1, 17, 24 and 27 being in independent form.

The abstract was objected to as purportedly too long and not in a single paragraph.

By this Amendment, the abstract has been amended.

Withdrawal of the objection to the abstract is respectfully requested.

Claims 1-23 were rejected under 35 U.S.C. §112, second paragraph, as allegedly indefinite.

In response, the claims have been carefully reviewed and amended with particular attention to the points raised in the Office Action.

Withdrawal of the rejection under 35 U.S.C. §112, second paragraph, is respectfully requested.

Claims 1-23 were rejected under 35 U.S.C. § 102(f) in view of J.P. Pipe, "The use of Parallel Imaging with PROPELLER DWI", Proc. Int'l Soc. Mag. Reson. Med. 11 (July 10-16, 2003.

It should be noted that the present application is a U.S. national phase application under 35 U.S.C. 371 of International Application No. PCT/JP2004/005928 which claims the priority of Japanese patent application no. 2003-119403, filed with the Japanese Patent Office on April 24, 2003.

On the other hand, Pipe was published no earlier than July 10, 2003. Attached as Exhibit A hereto are the cover page and the tables of content page of the Proceeding of the International Society for Magnetic Resonance in Medicine (10-16 July 2003) which indicate that the earliest possible date that Pipe was available to the public was July 10, 2003.

Accordingly, since the April 24, 2003 priority date of this application predates the July 10, 2003 publication date of Pipe, Pipe is not prior art to the present application.

Further it is noted that for a reference to be anticipatory, it must be enabling.

Applicant submits that Pipe is not enabling.

In addition, the Office Action fails to indicate where one can find teaching or suggestion in Pipe of each of the following aspects of a magnetic resonance imaging method comprising a unit region measuring step of measuring echo signals from a subject corresponding to a unit region having an origin of a k-space and a specific width from a low spatial frequency region to a high spatial frequency region, and a unit region image forming step of forming an image of the unit region from echo signals corresponding to the unit region, while changing an angle of rotation of the unit region about the origin of the k-space, so that an entire image is formed by fusing plural unit region images, the magnetic resonance imaging method being characterized in that, in the unit region measuring step, measurements of the echo signals are skipped in at least one unit region, as provided by the subject matter of claim 1 of the present application

Independent claim 17 is patentably distinct from the cited art for at least similar reasons.

Likewise, Pipe fails to teach or suggest the subject matter of new independent claims 24 and 27.

Pipe, as understood by Applicant, proposes in "METHODS and RESULT' that B1 map

data is collected for all slices in a single TR with a single unaliased blade. This means that B1 map data is generated from echo signal data of a single unaliased blade, whose lines are all measured without skipping any of them, and whose distance between neighboring lines in k-space is narrower than that of other aliased blades for constructing an image with parallel imaging method. In such an approach, extra time is necessary for collecting B1 map data at a dense blade, such as the unaliased blade, and much time is consumed to form an entire image. Further, more accurate B1 map data needs denser and longer-time measurement of the single unaliased blade.

In contrast, in the claimed subject matter of new claims 24-29 of the present application, sensitivity distribution data of each receiver coil unit is generated from the echo signal data of the low special frequency regions of plural unit regions, not just a single unit region. By using echo signal data of the low special frequency regions of plural unit regions, each of which has one or more lines skipped to be measured, enough dense data come into available at overlapped low special frequency region of each unit region without extending measurement time for generating the sensitivity distribution data even if each unit region is sparsely measured. Therefore, the subject matter of new claims 24-29 can obtain accurate sensitivity distribution data of each receiver coil unit with no extra time for measurement thereof.

In view of the remarks hereinabove, Applicant submits that the application is now in condition for allowance. Accordingly, Applicant earnestly solicits the allowance of the application

If a petition for an extension of time is required to make this response timely, this paper should be considered to be such a petition. The Patent Office is hereby authorized to charge any

fees that are required in connection with this amendment and to credit any overpayment to our Deposit Account No. 03-3125.

If a telephone interview could advance the prosecution of this application, the Examiner is respectfully requested to call the undersigned attorney.

Respectfully submitted,

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Cooper & Dunham LLP
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EXHIBIT A

to
AMENDMENT
(Serial No. 10/553,900)

INTERNATIONAL SOCIETY FOR

ISMRM

MAGNETIC RESONANCE IN MEDICINE

PROCEEDINGS

of the

International Society for Magnetic Resonance in Medicine

ELEVENTH SCIENTIFIC MEETING AND EXHIBITION
Toronto, Ontario, Canada
10-16 July 2003

ISSN NUMBER 1545-4428

Saturday AM

OPENING SESSION

Hall F/G 07:45 – 08:20

07:45 **Welcome and Medal Presentations**
Richard L. Ehman, President

SEVENTH ANNUAL LAUTERBUR LECTURE

Hall F/G 08:20 – 09:00

08:20 **The Legacy of I.I. Rabi**
Norman F Ramsey[1]
[1]Harvard University, Cambridge, Massachusetts, USA

The Toronto Keynote Lecture

Hall F/G 09:00 - 09:25

09:00 *1.* **Future Directions in Funded Biomedical Imaging Research**
Roderic I. Pettigrew[1]
[1]National Institutes of Health, National Institute of Biomedical Imaging and Bioengineering, Bethesda, Maryland, USA

The landscape of biomedical research is undergoing a significant change consequent to the merger of technology and biomedicine. At the intersection of these scientific fields is the promise of new fundamental discoveries and significant progress in the understanding and management of disease. The recent creation of the National Institute of Biomedical Imaging and Bioengineering is in large part a response to this evolutionary landscape change toward technology enabled biomedical research and the promise of realizing a significant positive impact on the world's health care agenda.

Serial No. 10/553,900

11:12 64. **Ultra-high Resolution SENSE-DTI at 3 Tesla**

Thomas Jaermann[1], Klaas Paul Pruessmann[1], Anton Valavanis[2], Spyros Kollias[2], Peter Boesiger[1]
[1]ETH and University Zurich, Zurich, Switzerland; [2]University Hospital Zurich, Zurich, Switzerland

Limited spatial resolution is a key problem in increasing efforts to study brain white matter structure with Diffusion Tensor Imaging (DTI). Commonly relying on spin-echo EPI sequences, DTI's ability to resolve small details is seriously restricted by T2 and T2* decay, B0 inhomogeneity, and limited signal-to-noise ratio (SNR). In this work we demonstrate that all of these issues can be addressed at once by parallel acquisition. It is shown that parallel imaging at 3 Tesla indeed permits pushing spatial resolution to the sub-millimeter realm while reducing artifacts and even increasing SNR efficiency at the same time.

11:24 65. **High-resolution DTI of the Brainstem-Cerebellum Areas using 3T and SENSE Acquisition Technique**

Lidia Mayumi Nagae-Poetscher[1], Hangyi Jiang[1], Setsu Wakana[1], Xavier Golay[1], Peter van Zijl[1], Susumu Mori[1]
[1]Johns Hopkins University, and F.M Kirby Research Center, Kennedy Krieger Institute, Baltimore, Maryland, USA

High-resolution diffusion tensor imaging (DTI) of the brain stem-cerebellum was performed using SENSE (R=3) at 3 Tesla. When using 1.8mm isotropic resolution, identification of a higher number of structures could be achieved, as compared to 1.5 Tesla. For instance, compartments of the spinal cord were identified, as well as inferior olivary nucleus, optic tract, cranial nerves III, V, dorsal and medial longitudinal fasciculus area, deep cerebellar nuclei and decussation of superior cerebellar peduncle. Identification of those structures brings up the possibility for DTI to have an impact on the diagnosis and prognosis of diseases affecting such structures.

11:36 66. **The Use of Parallel Imaging with PROPELLER DWI**

James G. Pipe[1]
[1]Barrow Neurological Institute, Phoenix, Arizona, USA

Parallel Imaging has been implemented for PROPELLER diffusion weighted imaging. Although this will work with any parallel imaging method, the combination of multiple-coil data occurs at a different stage in reconstruction than for most other methods. The result gives one the ability to reduce scan time and artifacts for PROPELLER DWI at the typical expense of SNR.

11:48 67. **Diffusion Mapping with Serial Asymmetric Spin-Echo EPI**

Nan-kuei Chen[1], Robert V. Mulkern[2], Charles R. G. Guttmann[1], Lawrence P. Panych[1]
[1]Brigham and Women's Hospital, Boston, Massachusetts, USA; [2]Children's Hospital, Boston, Massachusetts, USA

A quantitative diffusion mapping method based on serial asymmetric-spin-echo EPI is developed. Unlike conventional spin-echo EPI based diffusion mapping in which the same experimental settings are repeatedly used for multiple averages, the new method acquires a series of diffusion-weighted EPI with graded T2*-weighting. Both field inhomogeneity and diffusion quantities can be measured. Inconsistent field distortions due to varying eddy current effects can then be characterized and removed. Using the proposed technique, the achieved signal-to-noise ratio per scan time is comparable to that obtained with the conventional approach but artifacts may be further reduced using the obtained field distortion maps.

12:00 68. **Diffusion Weighted EPI with Magnetization Transfer Contrast**

Rakesh K. Gupta[1], Anasuya M. Rao[2], A Kasiviswanathan[2], Sanjeev Chawla[1], Rajesh Kumar[1], Ramesh Venkatesan[2]
[1]Sanjay Gandhi Postgraduate Institute of Medical Sciences, Lucknow, UttarPradesh, India; [2]Wipro GE Medical System, Bangalore, Karnataka, India

We have performed diffusion weighted (DW) echo planar imaging (EPI) with and without magnetization transfer preparation pulse to see the effect of macromolecular suppression on apparent diffusion coefficient (ADC) in the brain parenchyma of 10 healthy volunteers. There was a significant increase in the ADC values in different locations of the brain parenchyma after the application of Magnetization Transfer (MT) preparation pulse, suggesting that there is some relationship between the macromolecular concentration and water diffusivity across the cell membrane. This information may be of value in better understanding the pathological processes with variable macromolecular concentrations.

12:12 69. **High-Resolution Diffusion-Weighted MRI using Variable Density Spiral Acquisition**

Tie Qiang Li[1], Dong-Hyun Kim[2]
[1]Indiana University School of Medicine, Indianapolis, Indiana, USA; [2]Stanford University School of Medicine, Stanford, California, USA

A self-navigated multi-shot MR pulse sequence based on variable density spiral trajectory was implemented for high-resolution diffusion-weighted MRI. The k-space trajectory design was calculated on-line using a simple analytical approximation and the sampling density follows a hanning window function. Due to the over sampling of the center k-space, this 2D self-navigator allows more robust motion correction and the high resolution diffusion-weighted images (256x256) acquired using 8 spiral interleaves is of high quality even without elaborate correction schemes.

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